Center Innovation Fund: JSC CIF

Quiet Fan Technology for Deep Space - Year 2

Completed Technology Project (2017 - 2018)

Project Introduction

Reducing ambient noise levels in space environments plays a key role in crew communications, ability to sleep, and overall crew comfort and well-being. Deep space missions are especially susceptible to noise due to the confined nature of their environment and the lack of respite from noise. This technology is significant to deep space missions because it can reduce fan noise within the existing hardware footprint, reducing the need for bulky passive treatments such as added duct work & internal linings.

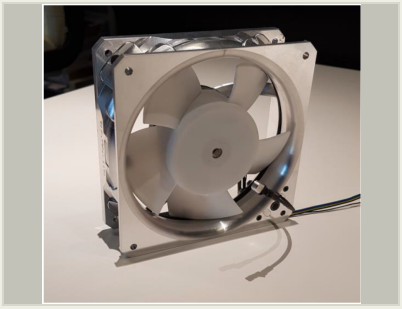
Working with RotoSub, our goal was to improve on our year 1 work (adapting this technology into Crew Quarters (CQ) fans) by preparing these fans for flight on ISS as a CQ technology demonstration. This was accomplished by additional noise control improvements, fan blade optimization, integration of electronics into the fan/frame, and creating a robust aluminum housing.

We partnered with Lars Strömbäck and RotoSub AB out of Sweden to adapt and integrate their ANC quiet fan technology into CQ type fans. Danielle Koch from the NASA Glenn Research Center provided for the loan of their ISO 10302 Fan Sound Power Plenum for fan testing. Currently we are working with Holly Cagle & the Flight Crew Systems office at JSC for CQ integration on the ISS.

Anticipated Benefits

Pending additional funding, we will continue to work with RotoSub to prepare this Quiet Fan for integration into on of the Crew Quarters as a demonstration of this technology. There are a few additional steps needed to have this fan flight ready, including creating a injection molded cast for the fan rotor (rather than a 3D printed rotor), and any other optimizations defined through acoustic refinement and testing of this year two fan. The intent is to certify and fly these fans as a technology demonstration, where they would replace the two existing CQ fans in one of the ISS Crew Quarters.

The long term benefits of this technology for spaceflight are significant. This technology effectively reduces noise while maintaining and even slightly improving fan performance. Integrating this technology into space vehicles will result in considerable mass and volume savings, which is extremely valuable in any space vehicle and especially so in a deep space vehicle or habitat like Orion and Lunar Orbital Platform - Gateway.



this year 2 quiet fan version integrates improved blade profile design, improved blade/hub attachments, integrated electronics, and a microphone integrated into the fan frame.

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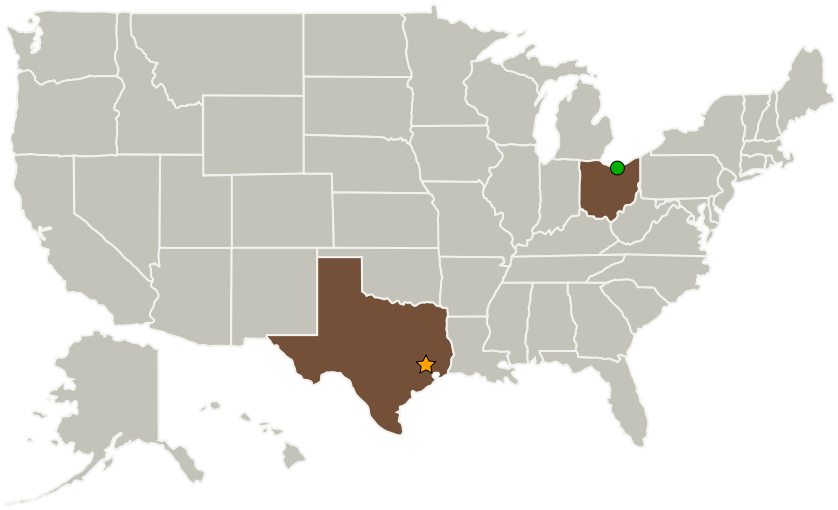
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
●Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Texas

Project Transitions

October 2017: Project Start

September 2018: Closed out

Closeout Summary: Year 2 work has been completed on the Quiet Fan projec t. This is a promising technology we are working with ISS to demonstrate in the near future.

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Carlos H Westhelle

Principal Investigator:

Christopher S Allen

Co-Investigator:

Andrew J Boone

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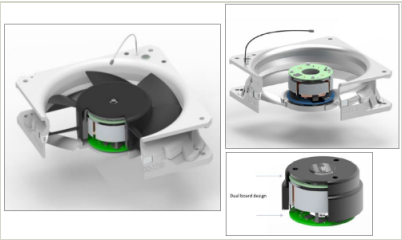
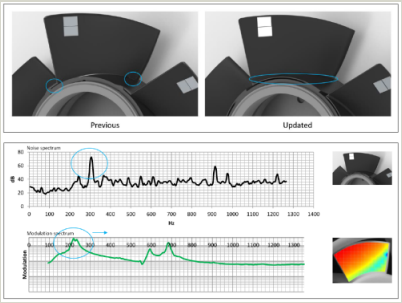
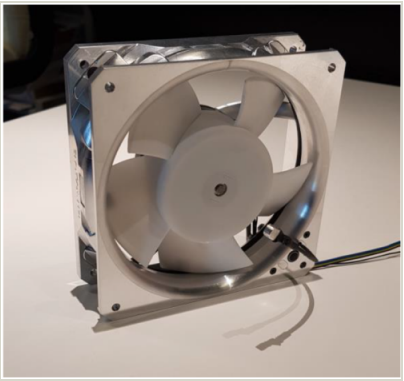
Images



Electronics Improvements
Dual PCB board design with electronics integrated into the motor hub
(https://techport.nasa.gov/image/34692)



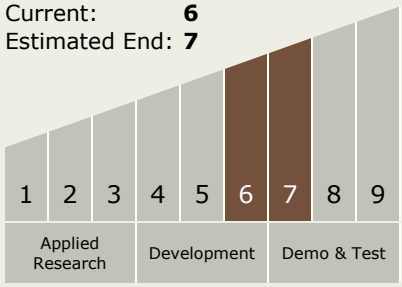
Modulation Improvements
Improvements in blade hub attachment allow for more powerful and effective modulation control
(https://techport.nasa.gov/image/34691)



Year 2 Quiet Fan
this year 2 quiet fan version integrates improved blade profile design, improved blade/hub attachments, integrated electronics, and a microphone integrated into the fan frame.
(https://techport.nasa.gov/image/34690)

Technology Maturity (TRL)

Start: **6**
Current: **6**
Estimated End: **7**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.1 Logistics Management

Target Destinations

Earth, The Moon, Mars